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TITLE: DETECTABLE WARNING SYSTEM

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DOC NO.: G780

BACKGROUND OF THE INVENTION

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The invention relates to a detectable warning system. More particularly, the invention relates to a system for easily and effectively applying prefabricated detectable warnings to pavement to provide a tactile warning to pedestrians regarding a hazardous transition.

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It is well known that persons with little or no usable vision depend upon environmental cues--ambient sounds, edges and other physical elements that can be sensed by a cane, and texture changes underfoot--for safe and independent travel.

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People with low vision can also use color contrast as a navigation aid. When raised curbs do not mark and separate the pedestrian route on a sidewalk from the vehicular way, as at curb ramps, vehicle drop-offs, or depressed corners at

intersections, it is difficult for some pedestrians to discern the boundary between pedestrian safety and hazard.

Because of the inherent danger caused by transitions  
5 without textural changes, the Americans with Disabilities Act  
Accessibility Guidelines (ADAAG) requires that detectable  
warnings be installed onto pavement or ground surfaces at  
certain hazardous junctures. The detectable warnings provide  
a contrasting texture that signals a hazardous condition to  
10 the pedestrian, and thereby informs the pedestrian to  
exercise care. In particular, the current regulation  
requires that the detectable warning consist of truncated  
domes having a nominal diameter of 0.9 inches, protruding  
from the ground surface to a height of 0.2 inches, and having  
15 a center-to-center spacing of 2.35 inches. In addition, the  
warning should be of contrasting color to effectively warn  
those who have greatly reduced vision.

In many cases, the warnings must be retrofitted onto  
20 existing ground surfaces. Further, the installation of such  
warnings is not readily compatible with standard paving  
techniques. Accordingly, the detectable warnings are most  
typically installed onto already existing pavement surfaces.

25 Some have proposed systems for the creation and  
installation of the domes. Generally these systems involve  
the use of templates to create the dome "in place". Others

have proposed systems of prefabricated warning domes. For example, TOPMARK proposes a system of preformed thermoplastic detectable warnings that is installed in sheets that have a plurality of thermoplastic domes. Unfortunately, the use of thermoplastic warning domes makes the system extremely difficult to install, since heat must be used to install the sheets, but heat will deform or destroy the thermoplastic domes.

10        While these units may be suitable for the particular purpose employed, or for general use, they would not be as suitable for the purposes of the present invention as disclosed hereafter.

## SUMMARY OF THE INVENTION

It is an object of the invention to provide a system for allowing the effective installation of detectable warnings upon a pavement surface. Accordingly, the detectable warnings are made of a heat resistant casting material that is "sandwiched" between two layers of thermoplastic. The thermoplastic allows the warnings to be effectively mounted and evenly distributed on the pavement surface.

It is another object of the invention to provide a system for allowing the easy fabrication of detectable warning domes carriers for quick and easy subsequent installation of a plurality of domes simultaneously.

Accordingly, a mold is used to initially create a top layer of thermoplastic material, create the detectable warning domes thereupon, and then create a base layer that sandwiches the detectable warning domes between said base layer and the top layer. Upon removal from the mold, the detectable warning dome carriers may be easily adhered to pavement surfaces by the application of heat.

The invention is a detectable warning system, for tactily signaling the presence of a terrain transition to a pedestrian, using a plurality of detectable warning domes that are arranged in a grid within a detectable warning carrier assembly. The detectable warning carrier assembly

comprises a top layer and base layer of thermoplastic material with heat resistant detectable warning domes therebetween. The base layer is heated and adhered to a pavement surface. The detectable warning domes protrude from  
5 the pavement surface in an evenly spaced pattern that is detectable by the pedestrian using a cane or other guidance instrument.

To the accomplishment of the above and related objects  
10 the invention may be embodied in the form illustrated in the accompanying drawings. Attention is called to the fact, however, that the drawings are illustrative only. Variations are contemplated as being part of the invention, limited only by the scope of the claims.

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## BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings, like elements are depicted by like reference numerals. The drawings are briefly described as follows.

FIG 1 is a diagrammatic perspective view illustrating a detectable warning carrier assembly, having a plurality of detectable warning domes encased between two layers of thermoplastic.

FIG 2 is a cross sectional view of a mold used in the creation of the detectable warning carrier assembly, wherein a thermoplastic sheet has been placed to span the mold and extend across a plurality of dome forming cavities.

FIG 3 is a cross sectional view similar to FIG 2, except wherein heat is applied to melt the thermoplastic sheet so that it conforms to contours of the mold.

FIG 4 is a cross sectional view, similar to FIG 3, except wherein a heat resistant casting material has been added to the mold to form detectable warning domes within the dome forming cavities.

FIG 5 is a cross sectional view, similar to FIG 4, except wherein a second thermoplastic sheet has been extended

across the dome forming cavities, spanning the mold, and heat is being applied thereto to join the second thermoplastic sheet to the existing thermoplastic to encase the detectable warning domes therebetween.

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FIG 6 is a cross sectional view of the detectable warning carrier assembly, as formed in FIG 2-5, removed from the mold, inverted, and ready for installation.

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FIG 7 is a diagrammatic perspective view, illustrating the detectable warning carrier assembly installed onto a pavement surface found at a curb cut.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG 1 illustrates a detectable warning carrier assembly 10 comprising a plurality of detectable warning domes 12 arranged in an evenly spaced, grid-like pattern, and encased between a base layer 14 and a top layer 16. The carrier assembly 10 is substantially planar in between detectable warning domes 12. The domes 12 are preferably truncated, such that they are flattened on top.

To facilitate proper application of the detectable warning carrier assembly 10, the base layer 14 and top layer 16 are preferably made of thermoplastic. The use of thermoplastic allows the base layer 14 and top layer 16 to melt so as to conform to the contours of the recipient surface, and to effectively bond with said recipient surface by flowing into cracks and pores present thereon.

Referring to FIG 2, formation of the detectable warning carrier assembly centers upon a mold 20 having a top surface 22 and a plurality of dome forming cavities 24 extending downwardly from the top surface 22. The dome forming cavities 24 are shaped like inverted truncated warning domes and are spaced apart as required by regulations such as ADAAG 4.29.2, and to otherwise function as an effective detectable warning. The dome forming cavities 24 are dimensionally



modified to accommodate a coating of thermoplastic as will be apparent hereinafter.

A first sheet of thermoplastic 26 is illustrated  
5 extending across the top surface 22, spanning the mold 20,  
and thereby extending across all dome forming cavities 24.  
The first sheet of thermoplastic 26 may actually be numerous  
sheets of thermoplastic that are adjacent and/or overlap each  
other so that they together substantially span the top  
10 surface 22 of the mold 20.

Referring now to FIG 3, heat 28 is applied to the  
thermoplastic sheet 26 to a temperature sufficient to  
substantially melt the first sheet of thermoplastic, so that  
15 it forms a one-piece, continuous, top layer 16 of the  
detectable warning carrier assembly 10 being formed.  
Accordingly the top layer 16 flows into the dome forming  
cavities 24 where it conforms to the mold 20, taking the  
shape of the dome forming cavities 24, and spanning the top  
20 surface 22 with one continuous piece. The top layer 16,  
however, is substantially thin, and thus does not fill the  
dome forming cavities 24, nor does it substantially obscure  
the topography thereof.

25 Referring now to FIG 4, heat resistant casting material  
30 has been added to substantially fill each of the dome  
forming cavities 24. In particular, the dome forming

cavities 24 have been filed to a height substantially equivalent to the top surface 22, or more particularly – to substantially the height of the top layer 16 as it extends across the top surface 22. The heat resistant casting material is flowable but settable, hardens in time, and is preferably a masonry material such as concrete. Note that the casting material is shown as uneven at its uppermost surface – this is to emphasize its flowability and viscosity. The casting material will, however, settle and form a substantially flat dome base surface 12A, as seen in FIG 5. Note that prior to the addition of the casting material, sand may optionally be sprinkled into the mold, while the thermoplastic is still hot, to adhere to the not-yet-cured top layer. Such sand may be added to facilitate a strong bond between the casting material and the thermoplastic top layer. Alternatively, formable heat resistant plastic, such as thermosetting plastic, may be introduced into the mold to form the domes. Once set, such plastic will resist subsequent melting, but may melt slightly on the surface sufficient to establish a strong bond between the dome and top layer 16.

If additional strength is desired, a strengthening grid, such as a mesh material, can be introduced at this point.

Accordingly, such a mesh grid can be placed upon the top layer 16 so that it substantially spans the mold, and adheres to all domes. The additional strength provided by the

strengthening grid helps make the invention more suitable for use on a surface where vehicles or other heavy equipment might be used.

5           In this regard, rather than casting the domes in place, performed domes can be introduced into the mold, with or without a pre-existing mesh grid holding a plurality of domes together. For example, the domes may be injection molded in a group, wherein members that connect the domes together are  
10 simultaneously formed during the injection molding process. The entire grouping of domes can then be placed within the dome forming cavities with the connecting members extending parallel to the top surface 22 of the mold 20. In such a case, the domes are made of a heat resistant plastic  
15 material. In addition, a plurality of domes can be joined and mounted upon a veneer of brick or other earthen material. The domes and veneer are then placed into the mold, with the domes resting against the top layer 16 within the dome forming cavities. The domes and veneer (along with adjacent  
20 veneers holding their own domes) are then encapsulated within thermoplastic material when the base layer 14 is subsequently formed.

          As seen in FIG 5, once the heat resistant casting  
25 material cures to form the detectable warning domes 12, it is covered by a second sheet of thermoplastic material 32 to coat the detectable warning domes 12 and base layer 14 with a

continuous piece of thermoplastic material. In particular, the second sheet of thermoplastic material 32 spans the mold 20, covers all the detectable warning domes 12 (inverted and within the dome forming cavities), and substantially covers the top layer 16. Then, heat 28 is applied once again to bring the second sheet of thermoplastic material 32 into a melted or plastic state so that it flows to adhere to both the top layer 16 and the detectable warning domes 12. Thus, the second sheet of thermoplastic material 32 becomes the base layer 14 of the detectable warning carrier assembly 10.

Referring now to FIG 6, after cooling, the detectable warning carrier assembly 10 may be removed from the mold - by separating the top layer 16 from the mold. The carrier assembly 10 is then inverted. As illustrated, when fabricated carefully, the base layer 14 is substantially planar, and the top layer 16 is contoured to extend over the domes 12 - yet remains substantially planar between domes 12. In addition, the domes 12 have a substantially flat base layer 12A. As a result, the domes 12 are sandwiched between the top layer 16 and base layer 14, and are thereby encapsulated in thermoplastic.

Referring to FIG 7, to install the detectable warning carrier assembly 10, the base layer 14 is placed upon a pavement surface 40 near a hazardous transition point 42. In particular, a curb cut 44 creates the transition point 42 at

which it is necessary to provide a textured, tactile warning. When suitably positioned adjacent to the hazardous transition point, and trimmed to fit, heat is applied to partially melt the base layer 14. A simple torch may be used to supply the  
5 necessary heat. As the base layer 14 melts, it will flow into cracks, crevices, and pores of the pavement 40. Once it has been allowed to cool, it remains permanently attached to the pavement 40, and the domes 12 will provide tactile feedback to any pedestrian approaching the transition point  
10 42.

In conclusion, herein is presented a detectable warning system for use on a pavement surface. The invention is illustrated by example in the drawing figures, and throughout  
15 the written description. It should be understood that numerous variations are possible, while adhering to the inventive concept. Such variations are contemplated as being a part of the present invention.